

Climates of the Canadian West

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THE CLIMATE OF THE CANADIAN WEST.¹

By ERNEST INGERSOLL.

It may seem presumptuous in me, the citizen of an outside power, however friendly, to come before an audience of Canadians as a lecturer upon their own country. But, in extenuation, I may plead that it has been my fortune to travel a great deal in all parts of Western America from Mexico to British Columbia; and, consequently, that I am not speaking from hearsay alone, but in the light of personal experience.

The climate, or rather climates, for there are several distinct climatic areas, of the vast western half of Canada, is, however, a matter of fact and science rather than of experience, and an intelligent man, though he had never been west of Lake Superior, nor heard a single word about its actual weather, could predict with much accuracy what kind of climate would be met by explorers in each of its various divisions, simply from knowing the physical situation of each.

For climate is very largely—almost wholly—a function, as mathematicians say, of, first, the latitude, and, second, the physical geography of the region under consideration.

¹ Abstract of a lecture in the Somerville Course, delivered in Montreal, March 15th, 1888.

By physical geography, I mean, here, the way in which the seas, mountains and plains of a sufficiently large district are disposed towards each other; and it is due to the close relation existing between these diversities of surface and climate, that the latter is not a whimsical thing, but one of the steadiest and most characteristic features of any region—even though the *weather* there may, at certain seasons, be most capricious.

The Canadian West I take to mean, for the purposes of this lecture, all of north-eastern America, from the limits of the forests around Hudson's Bay and Lake Superior, westward to the Pacific Ocean.

A glance at the map is the first thing in order.

We find that north of the International boundary line—or, better, let us say north of the watershed between Canadian rivers and those tributary to the Mississippi and the Missouri—there is an immense area of treeless plains nearly a thousand miles wide east and west, and stretching north-west, in triangular form, to the border of Alaska. This may be said to be *one* climatic area, which we may call that of the Plains.

West of the Plains stand the serried ranks of the grand old Rockies, forming a belt of snow-bearing mountains averaging 200 miles in breadth, and rising everywhere into the zone of perpetual snow and ice. This belt has a climate of its own, which we may term that of the Rocky Mountains. Beyond this lies the interior basin of British Columbia, about as large as Manitoba, forming a third climatic area, which may be named the *Kamloops* Climate, for want of a better term. A fourth climate, that of the rainy Coast Range, is attached to the narrow but lofty rank of mountains improperly called the Cascades, which extend parallel with the Pacific coast in southern British Columbia, and form the coast itself in the northern part of that Province. Last of all, there is the strip of lowland and the tongue-like valleys along the coast itself, together with the islands bordering it, which constitute a fifth climatic area. Each of these divisions is, in fact, a long strip of country,

north and south, conforming to the lines of coast and mountain ranges, by which their peculiarities in each case are governed.

We have, then, five separate and natural divisions of the West, each characterized by a climate of its own, depending upon its natural condition, as follows:—

1st—The Plains.

2nd—The Rocky Mountains.

3rd—The Interior of British Columbia.

4th—The Coast Mountains.

5th—The Pacific Littoral.

Let us take these up in reverse order, and so prepare ourselves for a study of the Plains, in which most persons are mainly interested.

It is almost needful, however, to consider the whole West as one, at first, in order to get at the philosophy of the subject in each separate case.

Remembering the northerly position of Canada, which gives it the general climatic features belonging to the Temperate Zone, we may say that every local peculiarity of climate in the West—at least beyond the central part of the Plains—is due to the arrangement of the currents of the Pacific Ocean, and its winds, on one hand, and to the position of the mountains in reference to them on the other. The reaction of ocean and mountains—of their influences, that is—upon each other, is really what makes the climate; and as the ocean currents and world-winds flow uniformly and unceasingly, while the mountains stand as the very type of permanence,—this reaction is necessarily constant, followed, of course, by uniformity in the visible effects.

With the course of the Gulf Stream all are familiar, and rightly attribute to its indirect influence the warm and moist climate of Great Britain and France, though those countries are as near to the arctic pole as the frigid cliffs of Labrador, where perennial winter holds sway.

Now, in the Pacific the case is the same. A great warm current out of the tropical seas courses up the eastern coast of Asia until it is fended away by the headlands of Siberia

and the Alaskan islands, and then turns to sweep southward along the coast of British America. The prevailing winds there, as everywhere else in the North Temperate Zone, are from the West; and these, after passing across thousands of miles of unobstructed and well-warmed ocean, come to us loaded with moisture. Warm air, you must remember, because expanded by its warmth, will absorb more moisture than cold, so that these Pacific winds are saturated by the time they reach the shore.

Now the mountains begin to do their part.

One cannot appreciate how important is the influence of the mountains of the globe upon its climates, until he stops to think what a state of things would exist in their absence. Weather is simply the state of the atmosphere in respect to temperature, dryness or wetness and the like. What affects these conditions causes a change in the weather. Were the surface of the continents flat, temperature would decrease from the equator precisely in ratio with the latitude, subject only to the influence of winds from the ocean, which would blow with unfailing regularity and continuance, bearing a definite quantity of moisture and depositing it, probably unceasingly, in the same place, year after year. Heat and cold in climate would then be almost entirely a matter of summer or winter, or distance from the equator, and wet weather would belong wholly to certain zones, migrating with the seasons, while all the rest of the world would be arid.

But the irregularities of the surface of the globe interfere with this, and make it a tolerable place to live. Without mountains (if we can conceive of such a state of things) the earth would scarcely be habitable—or at any rate comfortable. But the hills rise up toward the spaces of eternal frost which encircle the globe only a few thousand feet overhead, and act as condensers. The damp ocean air coming near them is cooled down to its dew point—that is, to a point where the invisible vapor of water it carries is changed into perceptible drops, clouds are formed and perhaps rain falls.

The higher the mountains, of course, the greater must be the condensation; because lofty summits are necessarily colder than those of less altitude.

With these general facts in view, let us now enquire as to the particular climates of British Columbia, which is to an extraordinary degree, a region of mountains and sea coast.

Vancouver Island and the Queen Charlotte archipelago have a climate upon which the inhabitants congratulate themselves. They have a mild and even winter, with rain, (the annual rainfall is estimated at 45 inches) and occasionally snow; an early spring; a dry, warm summer, and a clear, bright and enjoyable autumn. Sometimes the frost is sufficiently hard to permit of skating, but this is exceptional. As a rule flowers bloom in the gardens of Victoria throughout the year. The climate is warmer than that of England, and the rainfall is periodic—not irregular. The summer is decidedly dry, so that dust is one of the greatest inconveniences in every settlement. But it is a curious fact that July, the driest month on the coast, is the time of greatest wet in the interior. Fruits of all kinds indigenous of the temperate climates ripen in the open air, air, and amongst them some that are in England brought to perfection only under glass. Some of my hearers may remember an exhibition of apples, embracing some thirty varieties, all of extraordinary perfection, which grew near the mouth of the Fraser and were exhibited here in the early part of the winter. I have never seen plums and cherries to approach in size or flavor those of that region; and fruit culture will surely be one of the leading industries in the future of that coast. Thunder storms seldom break over the island. They can be heard in the distance but are rarely experienced. It is this climate, combined with the situation of Victoria, that makes that city so pleasing a contrast to those who visit it from the hot valleys of California.

Yet in the Interior of Vancouver Island mountains that rise more than 6,000 feet above the sea level not only hold the snow the year round, but even bear glaciers of large

size; and the climate of the Queen Charlotte Islands is cooler and more rainy than that of Vancouver, whose northern end, in turn, is less pleasant than its southern part.

Between the western, or oceanic, border of Vancouver Island, and the mainland coast, there is considerable difference, in favor of increased dryness and greater thermometrical range. That is, it becomes colder in mid-winter, and hotter in mid-summer than on the outer coast of the island. But the extreme in neither season is a hardship, and, on the whole, New Westminster and the new city of Vancouver have an even more agreeable climate than Victoria. People wear the same clothes the year round, and an umbrella must be a pretty constant part of one's outfit, except during the long and beautiful autumn, which is like a far-extended Indian summer.

The explanation of this climate has already been hinted at. The water of the Pacific is warm—20 degrees warmer than that of the North Atlantic near Canadian shores.

The prevailing south-westerly winds, sweeping over its surface, are raised to the temperature of the water, and become saturated with moisture, abstracting from it, and rendering "latent," in conformity with well-known physical laws, a still greater quantity of heat. When, on reaching the mountainous coast, this moisture is condensed and discharged, the latent heat becomes again apparent, and greatly raises the temperature of the atmosphere in which the reaction occurs. Hence the coast climate of the whole north-west coast of North America is warm. The mean annual temperature of Sitka is nearly the same as that of Montreal.

That the climate is wet as well as warm, is owing to the effect of the height of the coasts. The heaviest rainfall occurs in exact correspondence with the height to which the moist air is forced into the higher regions of the atmosphere, and cooled there by its expansion and loss of heat by radiation. In proportion to the elevation of the islands, and the degrees in which they shelter the mainland coast from the rain-bearing winds, the rain fall on the opposite coast

is more or less. The comparatively less rainfall of the coast of the south-western section of the mainland, (New Westminster district) than farther north, is owing to the abstraction of part of the moisture of the rain-bearing winds by their striking the mountains on Vancouver Island (where it is very wet), and to the lowness of the land about the mouth of the Fraser river.

This dampness produces that extraordinary growth of gigantic forests and vegetation characteristic of the Pacific slope; but this vegetation is distinctly northern in type, and the climate is far removed from a tropical one, where summer is eternal and proportionately enervating to man and beast. It is, on the contrary, though drier and steadier than England, in ordinary seasons not unlike the western counties, more particularly Devon and Cornwall.

Passing over the uninhabited ranges popularly known as the Cascades, whose summits reach eternal frost, and whose gorges are wet and densely wooded, we emerge on this side into a wholly different region. Instead of the lowlands of the Fraser delta, and the forests of almost tropical luxuriance that choke the narrow mountain-valleys, whose slopes are running with copious streams fed by an almost incessant rainfall, we have here, in the interior of British Columbia, wide areas of grassy plateaus and rounded hilltops. The rainfall of this southern interior is, in fact, slight and intermittent, and is insufficient for agriculture, so that farming must rely upon irrigation. For grazing, however, this condition of things is most favorable, and stockraising is likely to be the principal industry as far north as the rough, wooded country, which begins some 50 miles north of the railway. Yet the sky is often heavily clouded; but these clouds sweep overhead from west to east without shedding a drop of rain, though it may fall for days at a time on the mountains each side. The explanation, undoubtedly is: that the hot air, ascending from the heated and treeless plateau continually buoys up the clouds, and at the same time keeps them warmed above the point of condensation. Once in a while there is an interruption of this equilibrium in the shape of what is

called a "cloud burst," when the rain will fall in a deluge upon some limited space. It may truly be said of a region like this, that it never rains but it pours. This steady dryness of climate, coupled with its small altitude, makes the Kamloops and Okinagan districts a most excellent retreat for persons with pulmonary maladies, and many men are living there in health, who would not have survived within years of this time had they remained in eastern Canada. Here, where the thermometer rises occasionally to 110° in mid-summer, and the breeze is like the breath from the door of a furnace, the boastful natives have much to say of the refreshing effect of the cool nights. So they do on the coast, where the very air is sometimes greasy with warm steam and your strength dissolves as in a Turkish bath. But that claim is a matter of course! If there is one thing in this delusive world more certain than another, it is that every son of Adam will tell his friends (and most of all his enemies!) that where he lives the nights are cool and there are no mosquitoes.

But to resume: The winds that have swept ungenerously over the Kamloops downs are compelled to yield their burdens of moisture to the mountains on this side of the great Thompson River basin. Here the Gold Range, stretching north and south for 200 miles along the western bank of the Columbia, rears its ancient peaks into the sky and interrupts the westerly gales. Striking this cold barrier, the air is suddenly condensed and drops its rain. One would think, after seeing the downpour upon the Cascades that little would be left in the clouds for any region beyond; yet the Gold Range is as damp as the Cascade, and its fountains nourish the great group of the Shushwap and Okinagan lakes, and keep alive many rivers of the first class.

But the Gold Range is only the westernmost of three huge mountain-ranks, which together form the great *Cordillera* of Canada, a belt of snowy mountains 250 miles in width. It is fifty miles across the Gold Range from Great Shuswap Lake to the Columbia river; It is sixty miles across the Selkirks from the Columbia on the west to the same river on the east of the range; and it is 125 miles from that river

across the Rocky Mountains to the plains. None of these three divisions is formed by a single line of elevations, but each consists of lines and groups of mountains almost untraceable in their confusion. They stand athwart prevailing winds, and hundreds of their peaks rise far into the chill regions of upper air, where winter is perennial. The highest are nearest the eastern border, and by the time the winds from the Pacific Coast have struggled between the crags, and swept across the wide snow-fields and ice-beds of the Selkirks and the Rockies, they are almost as dry as the dust of a flour-mill. Hence, of course, the rain-fall and snow-fall are far greater in the Gold and Selkirk ranges, first encountered, than in the Rockies; and the western side of each range is far more wet than the eastern. The snow-fall in the Selkirks amounts to about 30ft. in depth, yet winter there is hardly three months long, and the weather, as a rule, is so mild that explorers and workmen find little inconvenience in tents and shanties, and are only comfortable at work by taking off all their coats and laboring in their shirtsleeves. In the Rockies, on the contrary, the snow-fall is comparatively light, and what falls wastes rapidly, so that the railway is never incommoded in this range. The cold, on the contrary, is often very severe, and the winter of longer duration than in the Selkirks. This contrast is easily explained: We have seen that the warm and damp currents of air from the Pacific Ocean are gradually deprived of their moisture by condensation against the cold peaks of the Gold and the Selkirk ranges of mountains, so that they reach the Rockies almost dry. The very fact of its contact with the ice and snow must cool the air somewhat, of course, but the philosophical explanation is behind this—the *warm* winds of the coast are *cool* winds in the Rockies, because they have become dry winds. In giving up their moisture by condensation they have lost heat; and in their further rarification, due to their lofty flight over the high peaks, they have parted with still more heat, in exact proportion to the height of their ascent. Everyone who has climbed a mountain or gone up in a balloon, has noted how

the coolness of the air increases in pace with its rarification. Professor McCleod, in the second lecture of this course, made this plain by his diagrams, showing how an increase of altitude above the sea is equal to an increase of latitude away from the Equator, until, on the tops of very lofty mountains truly polar weather exists. The summits of the eastern Rockies are not much higher, however, than the crests of the Gold and Selkirk ranges; and they are colder than their more western compeers, not because they are higher, but because they are more inland, and hence receive air already dry, rarified and well cooled.

It is this characteristic of the atmosphere of the eastern side of the Rockies—in the neighborhood of Banff Springs, for instance—which gives it such a sanitary value, particularly in diseases of the lungs and throat.

Now let us make a hasty review: The winds of British Columbia are, broadly speaking, from the west. They are warm from the ocean, and loaded with moisture. Condensing into fog at the coast, they give a uniform, English-like, muggy climate along the Pacific coast. Further condensed, they are less foggy, but produce a more cloudy sky and heavier rainfall on the coast mountains. Raised to the elevation of the crest of the Cascades or Coast range, they take a flying leap across the interior basin, discharging little rain on the Thompson valley,—leaving it subject to extreme cold in winter, excessive heat in summer, and drought all the time. Condensed again by the Gold Range, the moist winds give those mountains rain and heat almost equal to that of the Coast Range. Condensed still further, by the Selkirks, there is a copious rainfall and snowfall upon these mountains, and a further giving up of warmth, which greatly tempers the climate; but by the time the Selkirks are past, the winds have lost nearly all their moisture and warmth, and have been rarified by being forced to an average height of seven or eight thousand feet. Hence, when they pass to the Rockies they are dry and cool in summer—dry and very cold in winter. What little humidity and warmth they may retain is almost lost on the western slope,

and at the summit of the Rockies the atmosphere is almost perfectly thin, dry and cold. The eastern slope of the Rockies is sparsely supplied with trees, and those of small size, while the rivers are scanty, except those fed by the glaciers and great snow banks conserved upon the cold central heights, and slowly doled out to keep the streams running. No great freshets occur, as happens upon the Pacific slope.

Yet the eastern foothills of the Rockies have a milder climate, and earlier spring and less snow than the western base of the range. Why? Owing to the Chinook winds. But what are the Chinook winds? Currents of warm air—broad sheets—cataracts—of warm air falling down in mid-winter from the top of the Rockies. But why, if the air on the crest, where the wide spaces of snow lie, is deadly cold, should the breezes descending from those snow-fields be comfortably warm in winter? Simply because they *do* descend.

Here is the reversal of the previous condition. The air ascending the western side and at the top of the Rockies is cold because it is losing its moisture and becoming rarified; the air descending the eastern slope becomes condensed, picks up moisture with every part of its descent, and correspondingly develops, or gives up, the latent heat which invariably accompanies condensation. The Chinook, then, is a warm, dry wind, manufactured on the spot by the condensation of the mountain air as it sweeps down, increasing in density, absorbing moisture, and yielding up its latent heat. In summer the same breeze seems cool in comparison with the fierce radiation of the baked plains; but it is equally a Chinook.

This wind is marvelous in its effect. To it is due the pleasing dryness of even the deepest gorges and nooks in the rocks in summer, while in winter it clears the plains for hundreds of miles away from the mountains of nearly all the snow—always scanty in amount—with amazing celerity. A northern gale will blow for two or three days, forcing the mercury below zero, and bringing all the wide plains under

a foot or two of drifted snow. Cattle, horses and wild game can only huddle in sheltered hollows or hide among the groves along the river banks and hope for better times. All the pasture is covered with a blanket of snow, too deep to let an animal get a bite of grass. Then the wind lulls and a breeze from the west springs up. It is warm—almost balmy in contrast to the biting easterly or northerly snow-gales. Near the mountains only a few hours suffices to lick up all the snow, except from the gullies, into which it may have drifted to a great depth. Cattle and horses find the grass exposed, and resume their feeding. The cold has done them no harm, for there has been no wet snow or sleet. The genial influence of the balmy west wind is felt far down the Mackenzie, enabling the buffalo to wander almost as far as the arctic circle in that part of the country. Winter there, in fact, is neither so long nor so severe as on the lofty plateaus fifteen hundred miles southward, for the height above the sea is only a few hundred, instead of several thousand feet. McKenzie found spring along Peace River, in latitude 56°, so advanced by the 10th of May that the buffalo and their young were cropping the new grass on some of the most exposed uplands.

Eastward from the mountains the influence of the Chinook gradually fades out, and is superseded by the northerly and southerly currents of Manitoba, which flow up and down the great trough of Lake Winnipeg, the Red River valley, and the valley of the upper Mississippi.

In respect to the climate of Manitoba and the Saskatchewan prairies, there is one man to whom all of us are indebted for information drawn from an untiring and early experience, and sustained by a sound judgment. I refer to Prof. John Macoun, of the Geological Survey. His book "Manitoba and the Great Northwest," is a most admirable compendium of information in regard to all the natural aspects of that great region, and I have had it constantly before me in writing out these notes.

The Canadian plains, as has already been said, stretch from Red River westward to the Rocky Mountains, and

northward to the forests beyond the Saskatchewan — an area as spacious as Ontario and Quebec together. Over all this area a fair uniformity of climate prevails, characterized by a rigorous, but comparatively short winter, early spring, an intense and fairly rainy summer, and a prolonged dry autumn. The air is dry, healthy and invigorating, the warmth and rainfall favorable to agriculture, the winter weather and light snowfall well adapted to success in raising live-stock. Indian-corn and apples can be grown to the 50th parallel of latitude in Manitoba and still higher farther west; while wheat, barley and all the hardy vegetables attain full ripeness on the banks of the Peace River, in latitude 50°, — the parallel which touches the southern extremity of Greenland.

At Fort Dunvegan, on Peace River, thirteen degrees north of Toronto, or nearly as far as Cuba is south of it, the winters, as I have said, are milder than those of Manitoba or Ontario; and for the seven months, from April to October, constituting the period of cultivation, Dunvegan and Toronto do not vary more than about one-half a degree in average temperature; while, as compared with Halifax, the difference is in favor of Dunvegan. The frosts there do not linger in the spring as late as here in the neighborhood of Montreal, nor do they begin so early in the fall; — and everything which will grow here will ripen there, in many cases with greater luxuriance. Out of 212 species of plants seen along Peace River, near Dunvegan, 138 grow in the vicinity of Toronto, and the rest are such as belong to the Saskatchewan plains. The list includes a native cactus!

In view of these facts, it is evident that mere difference of latitude is of small account; and when we come to examine the isothermal lines marking similarity of mean summer temperature, we find that they curve far northward, the isotherm of an average summer temperature of 65°, which is that of this part of Quebec, curving through Georgian Bay, along the south shore of Lake Superior, and swinging northward through Manitoba and north of the Saskatchewan almost to Peace River. In other words, the

temperature in summer of the North Saskatchewan and Peace River valleys is substantially the same as that of Montreal and Quebec. Similarly, the isothermal lines that pass through the thickly settled districts near the southern boundary of the plains are those of northern Ohio and Illinois. In fact, it is a truth proved by long observation, that the summer climate, in relation to agriculture, is warmer all over the western plains than it is in central Ontario. Spring opens earlier, too. Plowing is very often begun, all the long way from Red River to the Rockies, by the last week in March; and in Manitoba, which is the coldest corner, spring is never postponed beyond April 5. In the fall, on the other hand, plowing may generally be continued until the first of December, and sometimes much later. The *Lethbridge News*, of February 16th, this year, (Lethbridge is near Fort McLeod, 100 miles south of Calgary), says: "Winter is generally believed to be practically at an end. The thermometer registered 57° at noon." Early in April, then, the sun dissipates the light snow, the dry air evaporates it, leaving the ground dry, and plowing and seeding go on simultaneously. In a few days the seed germinates, owing to the hot sunshine. The roots receive an abundance of moisture from the thawing soil, and penetrate to an astonishing depth into the loosened loam. By the time the rains and heat of June have come, abundance of roots have formed and the crop rushes to quick maturity. The enormous crops are owing just as much to the opening power of the frost as to the fertility of the soil; this is a peculiarly favorable effect of the swift change from sharp cold to intense heat which characterizes the climate of that region. The summer weather is often extremely hot—frequently reaching 100 degrees; but this is a scorching, not a sweltering heat. It is the direct burning of the sun's rays—not a heat resident in the air: hence you mark an instantaneous and grateful relief when you step into the shade, or catch the breeze. Sunstrokes and loss of vigor through heat, which so often accompany summer days here when the mercury may not go so very high, are almost un-

known effects in the West. I hesitate to mention the dear old claim of cool nights, dreading your smiles, yet it is a fact that as a rule they are too cool to sleep uncovered; and a sultry night is more rare, even, than a sultry day. This intensity of the heat makes up for the comparative shortness of the season of cultivation, urging grain to a far greater celerity of growth than proceeds in more southerly latitudes: nor should it be forgotten that the high latitude gives greater length of days—far more sunshine and growing time in each 24 hours—than can be had further south. On the Saskatchewan in midsummer the nights are only four or five hours long. It thus happens that vegetation has about as many working hours, so to speak—hours when sunlight is promoting growth—between seed time and harvest, as in the longer season but shorter days of Iowa.

This increased energy of growth has been remarkably manifested in some instances. The early spring wheat cultivated for forty years in the Selkirk settlement, before the birth of Manitoba, was originally an English winter wheat. More lately a winter wheat from Pennsylvania was transformed into a spring wheat in Manitoba after a single year's reproduction. The seed of a certain kind of Indian corn cultivated about Winnipeg was two weeks later in maturing when sown near St. Louis, whence it had originally been brought; but quickness in coming to maturity is in fact, characteristic of all the plants indigenous to the Northwest, and is a quality speedily acquired by imported plants—a point not only in agriculture, but a pretty fact for the evolutionist to ruminate upon.

Furthermore, the cool moist spring checks an undue luxuriance of stem, and allows the strength of the grain-plant to be expended on the head and fruit (that is the grain) which is what the prairie cultivator, unsolicitous in regard to manure, seeks to perfect. This vigor given to vegetation in cold climates is in accordance with the well formulated law that cultivated plants yield their greatest product near the northernmost limit at which they will grow. Rice and cotton are tropical plants, yet the products

of both these plants in Georgia and South Carolina, almost at the northern limit of their range, stand first in commercial rank in their respective markets. Indian corn, or maize, is sub-tropical, and in the West Indies grows to a height of 30 feet, but bears only a few stunted seeds, instead of the 125 bushels to the acre sometimes gathered in New York state, where the stalks are hardly one-eighth as high; while the first prize for number of kernels and general perfection was given to corn grown last year near Winnipeg, in competition with the whole of the United States. The potato, indigenous to the equatorial zone, becomes really good only in the temperate zone, and finest of all in the more northerly localities. The Northwest can beat the world in its potatoes and tuberous vegetables generally—another outrage on poor Ireland!

As for wheat—everyone interested in these matters ought to read the remarkable facts stated by Mr. J. W. Taylor, U.S. Consul at Winnipeg, in his numerous writings and speeches on this subject. Here again it is along the northern part of its range that the best product is obtained. The finest wheat grown in Europe comes from the Baltic shores; and in the United States from Minnesota and Dakota; and in this important grain we have our most striking example of what the climate of the Canadian West is in relation to agriculture. In southern Minnesota, Iowa, etc., more than two well-formed grains of wheat are seldom found in each cluster or fascicle forming one of the rows in a head. In Manitoba and Assiniboia (where the shortness of the straw is surprising to a stranger); *three* grains are habitually found. This is an addition of one-third to the yield of each acre. That means 30 bushels on the average instead of 20—\$15 instead of \$10 an acre at present prices. But wheat-grown along Peace River often shows four and five grains in the cluster!

This is not the whole of the story. The kernels are harder and better filled out than southward; and it is an established fact that varieties of wheat classed as "soft" in the Mississippi states regain their flinty texture and become "hard" in the Northwest.

During May, June and July rain, generally in the form of thunder-showers, is of almost daily occurrence; so that there is no lack of moisture for the sustenance of the growing crops, just when they need it most. This diminishes toward the west, however, and when the plateau beyond the *Coteau de Missouri*, with an elevation of 3,000, is reached, summer showers are less frequent and certain. Even here, however, it is quite sufficient, as experience shows, until the very foot-hills of the Rockies are approached, when irrigation becomes necessary to success in farming. Over the great mass of the tillable prairies, however, drought causes no apprehension; and there is a belief abroad that as wire fences, railway lines, buildings and other lightning conductors spread over the plains, a greater electric equilibrium will be maintained, and rain will tend to fall more frequently and equably than heretofore.

After the middle of July rains are few, and during harvest cease altogether. This is another marked advantage over our eastern provinces, where farmers have to contend with wet harvest-weather nearly every year.

Harvest begins by the first of August, and is uninterrupted. Hay has been stacked in the open air quite unprotected, for the farmer is sure that no deluging rains will fall upon, nor melting snows sink into it, to wash out its juices or mildew it underneath. The grain is stacked uncovered in the fields and threshed in the open air without fear of harm through dampness. You will see everywhere small stables for stock, some small granaries, and cellars for keeping vegetables; but hardly ever a barn for storing hay, straw or grain. The climate renders it unnecessary.

Over the whole of Canada's great west the climate is equally favorable for live-stock. As is usual in northerly regions, the grasses are of the best, and by reason of the absence of fall rains and wet winter snows, they dry up on the stalk—are cured into real hay as they stand, instead of rotting; and their nutritious juices are never washed out of them. Horses, cattle and sheep fatten on this prairie grass as well as upon the richest meadows of Ontario, and cows

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give an extraordinary quantity of milk, while the dryness of the air and ground is especially favorable to sheep as well as cattle.

How the Canadian plains, in spite of their interior and northerly situation, come to have so warm and dry a climate is worthy a moment's consideration, though the instruction which this audience has already received from Professor McCleod, makes any remarks from me hardly needful. It is to be remembered that south of western Canada lies the vast plains-country of the United States, an arid space thousands of square miles in extent, towards which blow steadily the warm currents of air from the Gulf of Mexico, attracted by the heated air issuing from these ample spaces of treeless land. The ground becomes baked, and the air, heated by contact with it, rises rarified in enormous volumes, sucking in the northward-bound currents to take its place, and at the same time buoying them up and preventing the condensation or precipitation of moisture. This overflow of heated air continually drifts polewards, or northward, where, it must not be forgotten, the land is far lower; and as it goes it is joined by similar currents from the Nevada and Idaho deserts, and from the coast of California and Oregon. Combined, this current pours steadily northward, attracted by the rarified air now rising from the Canadian plains, and still bearing a large part of its original moisture.

But over the Saskatchewan valley it meets the cooler air flowing from the north, also attracted by the heated prairies, and in contact with this cooling current the moisture of the south and west winds is condensed into clouds and falls as rain. A secondary characteristic of this movement is the diversion of the northward-blowing wind eastward, although, as the earlier lecturers in this Course have shown us, the natural tendency of these antitrades is toward the west.

But as winter approaches the conditions are altered. The cooling of the plains diminishes their attractive power, and the warm southerly winds tend away from the east, toward

the west, in accordance with cosmic laws. Down from the north come the cold and dry winds, unchecked by any obstacle, and the hot breath of Eolus is overcome by a frosty blast from Boréas' cold cheeks. How remarkably different would be the climate of Manitoba were there a high range of mountains between it and Hudson's Bay; or were the Saskatchewan occupied by an extensive inland sea!

It appears, then, that (apart from the influence of the Chinook, due to the presence of the Rocky Mountains) the reason the Canadian Northwest enjoys so warm and comparatively rainy a climate is, in a word, because it lies northward of arid plains of much higher elevation.

In this same condition seems to be found the valuable immunity which western Canada, and the northern border of United States enjoy from those fearful blizzards that devastate southern Dakota, and make cattle and cattlemen shiver even on the coast of Texas. These winds all come from the far Northwest, and have blown, perhaps, a thousand miles across Canada before they become blizzards. But their course over the Saskatchewan, Qu'Appelle and Assiniboine plains, and down the Winnipeg valley, is continually impeded. First, the country is everywhere uneven and often broken by respectable hills; second, large areas of it are covered with a scrub of bushes, or dotted with copses of trees, all of which check and divert the gale; third, these winds are moving steadily up grade, and their speed is as continuously checked by friction against the earth, as is that of a railway train climbing a gradient. A wind will blow down hill faster than up, just as a stone will roll down hill easier than it can be pushed up. Finally, the air in the north is so nearly the temperature of the gale that it is not sucked forward with greatly accelerated speed, until it nears the warmer latitudes where more heated and rarified air is rising from the more southerly plains, and this cold northern air is drawn in to fill the vacuum. But by the time the "norther" has reached Nebraska it finds itself blowing across plateau-lands, at the top of the hill, where there is not a bush nor tree nor range of hills, to check it, and the

vacuum is close in front. It has been a respectable wind in the Northwest; a terrible gale in Montana; in southern Dakota and Nebraska it becomes a death-dealing blizzard. Poor Nebraska and Dakota must always expect them; grateful Assiniboia and Alberta need never fear them. As for the Red River Valley region, its situation makes it subject occasionally to a very respectable imitation of a regular blizzard; but this is a far rarer and less severe visitation than in Minnesota, south of it.

How do the people who live in the North-west like this climate? They universally praise it and laud especially its healthfulness. They speak of it as extremely stimulating and conducive to good spirits and courage.

The secret of this is its dryness. The atmosphere is bright, and when in winter it is ~~very~~ cold there is seldom any wind. Let a man take ordinary care of himself, and he will live longer and grow stronger on these prairies than anywhere else in the world.

A peculiar exhilaration of body and soul belongs to the climate, especially in and about the Rockies, which is the choicest of regions for camping excursions and sporting trips. "No man should desire a soft life," wrote King Alfred the Great, but "roughing it," within reasonable grounds, is the marrow of a visit to the Rockies. What a pungent and wholesome savor to the taste there is in the very phrase. The zest with which one goes about an expedition of any kind in the Rocky Mountains is phenomenal in itself; I despair of making it credited by inexperienced lowlanders. We are told that the joys of Paradise will not only be greater than earthly pleasures, but that they will be still further magnified by our increased spiritual sensitiveness to the "good times" of Heaven. Well, in the same way, the senses are so quickened by the clear, vivifying climate, of the western uplands in summer, that an outdoor life is tenfold more pleasurable there than it could be in the east. And then, one's *sleep* in the crisp air, after the fatigues of the day, is sound and serene. You awake at daylight, perhaps, readjust your camp-blankets, and want,

again, to sleep. The sun may pour forth from the "golden window of the East," and flood the world with limpid light; the stars may pale and the jet of the midnight sky be diluted to that pale and perfect *morning* blue, into which you gaze to immeasurable depth; the air may become a pervading champagne, dry and delicate, every draught of which tingles the lungs and spurs the blood along the veins with joyous speed; the landscape may woo the eye with airy undulations of prairie or snow-pointed pinnacles lifted sharply against the azure; yet sleep claims you. That very quality of the atmosphere which contributes to all this beauty and makes it so delicious to be awake, makes it equally blessed to slumber. Lying there in the open air, breathing the pure elixir of the untainted mountains, you come to think even the confinement of a flapping tent oppressive, and the ventilation of a sheltering spruce-bough bad.